Draft
March 31, 2003

Headquarters AIR Human Factors Program
Draft 4

This document is the program plan for the human factors specialists for FY 03. It contains a break down of all of the major activities, milestones, timelines, and products. This is intended to be a living document which will be updated periodically.

Roles & Responsibilities:

Currently Human Factors Specialists at FAA HQ are primarily involved in two types of activities:

1. Developing policy (requirements and guidelines) for new avionics systems (typically through industry consensus documents such as RTCA MOPS, which are invoked by TSOs) and
2. Providing support of certification projects (ACO's) for which no policy exists, but policy is being (or should be) developed.

The activities to support these two primary tasks fall into two major categories: those that directly support CNS and those that are more cross cutting.

Summary of Human Factors Projects That AIR-100 Has Been Asked to Support

This section contains a list of key policy (Regulations, Advisory Circulars, TSOs, and Orders) as well as other key database projects which are currently being supported and anticipated to be supported throughout FY 03. Items resulting in Regulations and AC's are listed first.

	Type of Document	Topic	Focal Point
1.	Regulation & AC	Alerting (25.1322)	Donovan
2.	Regulation & AC	Human Factors (25.1301- sub-paragraph e)	Donovan
3.	Advisory Circular	Electronic Flight Bag	Kaliardos
4.	Advisory Circular	ADS-B Cockpit Display of Traffic Information (20 series)	Kaliardos
5.	Advisory Circular	Controls (draft 20 series)	Gallaway
6.	TSO & MOPS	Moving Map With Ownship	Donovan
7.	Order	Addressing Human Factors for Avionics as part of the TSO process (8100 series)	Donovan
8.	Report ?	Certification Process Study	Gallaway
9.	Database	Human factors certification issues	Gallaway
10.	Database	TSO Human Factors/Pilot Interface guidance	Kaliardos
11.	RTCA document	Integrated Modular Avionics	Gallaway
12.	Policy Memo & MOPS	Weather Displays	Donovan
13.	HF Roadmap	NEXCOM	Donovan
14.	AC 90-RNP & HF considerations Roadmap	RNP	Kaliardos
15.	Policy Memo	MSL-GSL	Kaliardos
16.		Focal point for AAR-100 Flight Technologies & Procedures (Research). Coordination- provide input /recommended changes to database.	Gallaway
		Non-Human Factors Projects	
17.	TSO (?)	Lighting	Gallaway
18.	Response to NTSB, Issue Paper	ELT	Kaliardos
19.	CD ROM	Avionics Workshop Presentations	Gallaway
20.	Several ACs, Memos, etc.	Get Up To Speed On Core Documents	Kaliardos & Gallaway

Projects not being supported

1. Multi-function display TSO Revision	2. CPDLC Tech Center Research (Rehmann work)	3. EFIS Part 23 Cert/ Standardization
4. Night Vision Gog. (NVG)	5. SC-189 Safety Assessment	6. ANM & ACE Roles & Responsibilities document
7. Synthetic Vision	8. AIR HF WEB page	9. AC 23.1523
10. RTCA SC-194		

Project Details

Project 1: Alerting (25.1322) Regulation and AC (Donovan)

This activity is part of the Avionics ARAC Harmonization Working Group activity. The group was tasked with harmonizing the FAA/JAA regulation on Alerting (25.1322) and associated advisory circular. The JAA has a published 25.1322 ACJ (equivalent of an FAA advisory circular). The FAA does not have an AC associated with the alerting regulation, so the product resulting from the group for the FAA would be a revised regulation and a new AC. The current regulation was deemed as insufficient and thus the group is working towards expanding the scope of that regulation to apply beyond just the color of the lights (red for warnings, amber for caution, etc.). After the group submits the alerting regulation and AC to the TAEIG, the group will begin working on an update to the electronic displays AC (25-11).

Products:

1. Revised alerting regulation 25.1322
2. New alerting AC 25.1322
3. Revised electronic displays AC (25-11)

Major Milestones	Timeline
1. Major draft distributed for internal review	Dec 2002 ♦
2. 25.1322 regulation & AC submitted to TAEIG	April 2003 ♦
3. Begin work on electronic displays AC (25-11)	April 2003 ♦
4. Draft distributed for internal review to HF specialists	Sept 2003

Project 2: Human Factors (25.1301 New subparagraph e) Regulation & AC (Donovan)

This activity is part of the Human Factors ARAC Harmonization Working Group activity. The group was tasked to identify deficiencies in the part 25 regulations associated with human factors and flight crew error and develop appropriate material. After several years working on the identification and prioritization of the deficiencies, the group has been working on new regulatory material to partially address those deficiencies as part of 25.1301, as well as developing an associated new advisory circular. The current version of the AC has the following subject areas:

1. Flight crew error
2. Automation
3. Interface Integration
4. Non-essential equipment
5. Displays
6. Controls
7. Pilot Characteristics
8. Test and Evaluation Process

Products:

1. New Subparagraph to 25.1301 (e) to address human factors and flight crew error
2. New Advisory circular to address human factors and flight crew error

Major Milestones	Timeline
1. Draft rule and AC distributed for internal WG review	January 2003 ♦
2. Provide comments on AC and draft rule-rework as necessary	April 2003 ♦
3. Working group agrees to rule language	June 2003

4.	Last WG meeting to finalize rule and AC	October 2003
5.	Working group submits final material (regulation and AC) to FAA	Nov 2003

Project 3: Electronic Flight Bag AC (120-76) (Kaliardos)

This activity is part of an internal FAA group working on a revision to the initially published electronic flight bag AC (120-76A). Revisions include allowing panning and zooming, as well as a new categorization scheme for what needs to be reviewed by Aircraft Certification vs. Flight Standards.

Products:
1. Updated AC 120-76

Major Milestones		Timeline
1.	Complete modification of Human Factors section of AC 120-76A	December 2002 ♦
2.	Draft distributed for public comment	December 2002 ♦
3.	AIR-130 non-concurs & AC language changed	January 2003 ♦
4.	Final draft submitted to legal prior to final sign-off	January 2003 ♦
5.	Revised AC (120-76A) published	March 17, 20003 ♦
6.	Analyze Volpe EFB document for inclusion into next revision of AC 120-76 and other FAA guidance material	April 2003
7.	Participate in Seattle EFB ACO Project	May 2003
8.	Draft new HF section for next AC revision	July 2003

Project 4: ADS-B Cockpit Display of Traffic Information AC (20 Series) (Kaliardos)

This activity is part of an internal FAA group working on a new cross-CFR advisory circular (20 series) to provide certification guidance. The purpose of this Advisory Circular is to provide cross FAR part (Regulations including part 23, 25, 27, & 29) guidance to facilitate the evaluation and approvals of surveillance systems, including CDTI. The AC will also provide guidance to the industry on what will be acceptable in terms of certification. Completion of this task entails working with Peter Skaves and Rob Duffer from AIR-130. This task also entails oversight of two research contracts. The first is being conducted at the Operator Performance group (Dr. Eric Nadler and Michelle Yeh) at the Volpe Transportation Systems Center (part of U.S. DOT), funded by Safe Flight 21. The second is research conducted by Dr. Esa M. Rantanen, Assistant Professor at University of Illinois at Urbana-Champaign, funded by AAR-100.

Products:
1. New Advisory Circular for approving surveillance systems (ADS-B/ CDTI)

Major Milestones	Timeline
1. Review TCAS design rationale	January 2003
2. Complete 1st draft of HF section of AC	Feb 2003
3. 1st Telecon. Overview/ status report of Illinois research with Esa Rantanen	Feb. 27, 2003
4. 2nd Telecon. Overview/ status report of Illinois	March 21, 2003

research with Esa Rantanen	
5. Inventory of TCAS and ADS-B boxes	April 2003
6. AC distributed for AIR-130/AFS-400 comment	May 2003
7. Comment disposition & modification of AC draft	June 2003
8. Distribute AC for public comment	Dec 2003

Project 5: Advisory Circular: Controls (Draft 20 Series) (Gallaway)

This would be a 20 series AC to provide general guidance on knobs, buttons, cursor control devices, touch screens etc. That is, traditional knob-controls, not flight controls. The need for this AC was made apparent from the issue papers generated from various integrated modular avionics (IMA) certification projects, all of which have unique issues with cursor control devices. Issues and some guidance was inserted into the IMA advisory circular, however the IMA AC team noted that guidance was general guidance and should be pulled out into a controls AC so that the guidance could be used on multiple projects, above and beyond IMA. Additionally, the human factors harmonization working group has been working some guidance for inclusion in the new Human Factors advisory circular. As we do not have a dedicated controls AC this seems acceptable, but not ideal because the new human factors AC is a 25 series AC. The proposed AC would extract and combine the controls material from the IMA AC and the draft Human Factors AC and be published in a new cross-CFR part (20 series) controls AC. Preliminary work on this AC will start this year.

Products:

1. Draft new Advisory Circular on controls (20 series)

Major Milestones	Timeline
1. Gather source material & input: • Gather controls guidance from various documents (IMA AC, draft HF AC, AC-25-11, AC 23.1322, Part 25 MOC Policy, etc.). • Gather controls issues from issue papers • Do literature search & industry/product review • Review Boyd's slides with issues • Talk to test pilots about controls issues- determine what is needed	April 2003
2. Develop outline- propose to HF specialists	April 2003
3. Initial draft of AC- distribute to Bill & Colleen. Re-work as needed based on input.	May 15, 2003
4. Distribute draft of AC to AIR HF specialists. Re-work based on input.	May 19, 2003
5. Distribute 2nd draft of AC to AIR HF specialists	July 2003
6. Submit for preliminary Technical Editorial/ Legal Review	August 2003

Project 6: TSO & MOPS: Moving Map with Ownship (Donovan)

RTCA SC-181 working group 4, informally known as the "moving map Minimum Operational Standards (MOPS) working group", completed the document published as RTCA DO-257 "Minimum Operational Performance Standards for the Depiction of Navigation Information on Electronic Maps" in September

2000. This document was developed to establish standards that could be invoked by an FAA Technical Standard Order to facilitate the certification of new moving map displays for situation awareness.

The new terms of reference chartered the group to "Revise DO-257, as necessary, to support the electronic depiction of airport surface situation awareness (SA) maps and vertical situation awareness displays. This should include requirements and guidelines for the electronic depiction of airport surface diagrams, ownship, ground path and vertical profile aspects of the display and associated controls." Additionally the group was asked to develop a chapter with standards for moving map displays to be used during RNP operations to be included in the RNP MOPS.

Products:

1. New Technical Standard Order for Moving Maps
2. Updated moving map mops (RTCA DO-257A)
3. New chapter for RNP MOPS on map displays used during RNP operations

Major Milestones	Timeline
1. RTCA Document sent to SC-181 for ballot (Final Review And Comment- FRAC)	December 2002 ♦
2. Comments due from SC-181	Feb 10, 2003 ♦
3. Initiate comment resolution and related changes to the draft	Feb 11-14, 2003 ♦
4. TSO sent for AIR coordination	Feb 24, 2003 ♦
5. Comments incorporated- new draft sent for final review	April 2003
6. RTCA Meeting- Vote to accept final document	June 2003
7. Final draft sent to RTCA PMC	July 2003
8. PMC approves document?	Aug 2003
9. TSO sent for public comment	Sept. 2003
10. TSO revised based on comments	Nov 2003
11. TSO published	Dec 2003

Project 7: Order: Addressing Human Factors for Avionics as Part of the TSO process (8100 series) (Donovan)

Notice 8110.98 was drafted by an FAA/industry team as part of RTCA Task Force IV (Streamlining Certification). The document was published initially as a Notice to enable the field personnel to get experience using it and to provide some time for a critique. Since Notices expire in one year, the document needs to be re-worked to addressed comments and recommended changes and then published as a permanent FAA Order.

This notice provides guidance to facilitate the identification and resolution of human factors/pilot interface issues associated with complex, integrated avionics submitted for new or amended Technical Standard Order Authorization. This notice has three parts. The first is a suggested Federal Aviation Administration (FAA) process for evaluating the human factors/pilot interface avionics issues as part of the TSO process. The second is a discussion of some of the more prevalent, re-occurring human factors/pilot interface issues that have been observed during previous avionics TSO projects. The third is an appendix (Appendix A) which contains requirements and recommendations extracted from TSOs and advisory circulars to aid in issue resolution.

Products:

1. New Order based on currently published Notice 8110.98

Major Milestones	Timeline
1. Put old Notice 8110.98 as an order in the Federal Register. Send directly to original RTCA TF IV team and key FAA players (test pilots, HF specialists, etc.) and industry representatives to solicit final comments.	April 2003
2. Comments due	May 2003
3. Disposition Comments and Change Draft	July 2003
4. Submit to Tech Editor and Legal	August 2003
5. Publish Order	

Project 8: Certification Process Study – Maintenance Human Factors Team (Gallaway)

This is a Certification Process Study solution team sub-group: maintenance human factors in Continued Airworthiness. Tasks are to look at CPS findings and observations, list/discuss things that have been done to mitigate the Finding/Observation (e.g., FAA-sponsored research, industry programs, and OEM programs/processes), and come up with a recommendation on what should be done with the Finding/Observation. Will also participate in response team re-write of reports and solution implementation. This task will entail coordinating with one of the FAA co-chairs (who works in Flight Standards) as well as AIR-140. Focus will be on the following issues presented in the CPS report:

Finding 1: Human performance is still the dominant factor in accidents:

- The processes used to determine and validate human responses to fail and methods to include human responses in safety assessments need to be improved.
- Design techniques, safety assessments, and regulations do not adequately address the subject of human error in design or in operations and maintenance.

Finding 15: Processes to detect and correct errors made by individuals in the design, certification, installation, repair, alteration, and operation of transport airplanes are inconsistent, allowing unacceptable errors in critical airworthiness areas.

Observation 1: OEM and operator's maintenance manuals, illustrated parts catalogs (IPC), wiring diagrams needed to maintain aircraft in an airworthy configuration after incorporation of service bulletins (SB) and airworthiness directives (AD), are not always revised to reflect each aircraft's approved configuration at the time the modification are implemented.

Observation 2: Some air carriers do more extensive oversight than others of their in0-house and outsourced flight operations and maintenance activities, with major safety and economic benefits.

Products:

1. Report including recommendations

Major Milestones	Timeline
1. Participate in first meeting to establish objectives, work plan, and task assignments	Feb. 13, 2003
2. Develop & finalize three documentation questionnaires for industry with William Rankin (Boeing): • Airline version • OEM version • OEM maintenance version	Mar 10, 2003
3. Distribute Airline version of questionnaire	March 2003
4. Obtain responses from Airline version of questionnaires returned	April 2003
5. Complete preparation of material for second working meeting – Compile OEM / Documentation Questionnaire	Meeting April 28, 2003

results and summary of issues (paper) for April 29th meeting Industry	
6. CPS Working Meeting	April 29-30, 2003
7. Distribute draft of working group final report to FAA AIR HF specialists	July 2003
8. Material ready for third working meeting	Sept. 11th for Meeting Mid Sept.
9. CPS Working Meeting	
10. Submit final working group report	Oct 2003

Project 9: Human Factors Certification Issues Database (Gallaway)

The idea for this database resulted from brainstorming session of the AIR-100 HF specialists (Gallaway, Kaliardos, and Donovan) on what could be done to streamline the identification and documentation of human factors issues during certification projects. It was noted that many common issues surface across various certification projects and it would be potentially beneficial to create a database of these issues. If the issues could be made more generic and de-sensitized so that they do not contain proprietary information the database could potentially be used as a fast and efficient way of generating generic issue papers. Users could quickly search the database and mark issues that apply to specific certification project. Once items had been marked they could be quickly gathered into a draft issue paper. This would streamline the certification process because it currently takes a significant effort to generate issue papers. This database could provide one partial solution. Additionally, it would be a good way of tracking re-occuring issues that need to be better addressed in new FAA policy (Acs, Orders, TSOs, etc.). This may eventually be tied into the HF Job Aid and/or the Human Factors Guidance Database. The specifics of the database will evolve over time as the idea and concept matures. This project will entail coordinating with AIR-120 working on database projects, including John Lewis and Hal Jensen.

Products:

1. New database of human factors certification issues

Major Milestones	Timeline
1. Contact: HF specialists & gather certification issue papers	April 15, 2003
2. Sort issues by topics/themes	April 30th
3. 1st pass at issues databases	May 30th

Project 10: Database of TSO Human Factors/Pilot Interface Guidance (Kaliardos)

The idea for this database resulted from brainstorming session of the AIR-100 HF specialists (Gallaway, Kaliardos, and Donovan) on what could be done to streamline the development of human factors guidance material for new FAA TSO's and Advisory Circulars. It was noted that many TSO's have similar topic/content areas and the same types of language frequently appears, but varies slightly across the different TSOs. One way to streamline the development would be to pull all of the HF/ pilot interface guidance from various TSOs and a few key Acs together into a database that could be sorted by topic. That way the HF specialists would have some language to start with when preparing a new TSO, or possibly a new AC. Some of this material was pulled together as part of Notice 8110.98. However, that Notice only contained guidance on a subset of areas. This database would instead be a more comprehensive set of a much larger set of human factors/pilot interface guidance from published TSOs, and select subset of Acs as well as some of the industry documents invoked or called out by those TSOs and Acs. An electronically searchable database of this magnitude would be much more efficient for real-time searches. It is envisioned that this guidance could be combined or integrated with the human factors certification issues database and the HF Job Aid.

Products:
1. New database of TSO Human Factors/Pilot Interface Guidance

Major Milestones	Timeline
1. Compile list of documents to be used (FAA only)	April 2003
2. Work on list of guidance topics/themes	May 2003
3. 1st pass at the guidance database	June 2003

Project 11: Integrated Modular Avionics (RTCA Document) (Gallaway)

RTCA SC-200 has been tasked with developing guidance beyond that in the recently published AC. The AC provides guidance for applicants involved in the integration, installation, certification, and continued airworthiness of IMA systems into an aircraft, when the IMA system utilizes hardware elements that comply with the IMA TSO (TSO-C153). The guidance applies to the entire IMA system, not just the hardware elements for systems on aircraft certificated under Title 14 of the Code of Federal Regulations (14 CFR) parts 23, 25, 27, 29, 33, and 35.

Products:
1. New RTCA IMA Document

Major Milestones 2003	Timeline
1. 1st RTCA Meeting	Feb 18-20, 2003
2. Draft HF Outline	March 21, 2003
3. Revised outline and 1st Draft of HF section of RTCA document available for review by AIR-130 HF folks (Colleen, Bill, & Kathy)	April 1, 2003
4. Send draft 1 version 2 of outline & HF section to WG members	April 4, 2003
5. Issues Paper Available (short issue paper of all IMA HF issues)- submit to Colleen	April 15, 2003
6. IMA HF Presentation (containing status report including summary of HF issues, IMA AC & TSO content, plus RTCA document contents & timeline)- submit to Colleen	April 15, 2003
7. Revise Draft outline and HF section based on comments	
8. Send Draft 2 of outline and HF section for review to AIR-130 HF folks (Colleen, Bill, & Kathy)	May 2, 2003
9. Revise draft outline and HF section based on comments	
10. Send Draft 2 version 2 of outline and HF section to WG members	May 9, 2003
11. May RTCA Working Meeting (Germany) ☺	5/19-22/03
12. Revised Issues Paper Available	June 20, 2003
13. Revised IMA HF Presentation	June 20, 2003
14. Draft 3 Available for Internal (AIR-130: Donovan, Bill, & Kathy) Review	August 4, 2003
15. 2nd Draft Sent to RTCA for Distribution	August 29, 2003
16. HF section for distribution to FAA HF Specialists	Sept 2002
17. Sept RTCA Working Meeting	9/9-11/03

Project 12: Weather Displays (Policy Memo & MOPS) (Donovan)

The policy memorandum was drafted by an internal FAA group. It intended to provide interim guidance for standardized use of the colors magenta, red, yellow, and or amber for cockpit display of weather information, given that concerns have also been raised over conflicts between the color usage guidance in RTCA Document, DO-267, *Minimum Aviation System Performance Standards for Flight Information Services - Broadcast Data Link,* and the published FAA Advisory Circulars on electronic displays. The guidance contained in this memorandum has been identified as necessary for near-term standardization of certification projects and is intended to be incorporated into a revision to RTCA DO-267, which will be invoked by a new Technical Standard Order (TSO) and Advisory Circular (AC).

Products:

1. New Policy Memo & Revised AC (?)
2. Revised RTCA Document-267

Major Milestones	Timeline
1. Policy Memo submitted for AIR coordination & draft submitted to SC-195	January 2003 ♦
2. Comments due	March 2003 ♦
3. Policy Memo revised based on comments received	April 2003
4. DO-267 Revised to incorporate Policy Memo	September 2003

Project 13: NEXCOM HF Roadmap (Donovan)

This document presents a comprehensive plan to mitigate risks associated with human factors in the next generation air/ground communications (nexcom) system. The human factors plan for the nexcom system considers the system functions allocated to the human elements and the expectations and risks associated with human performance of those functions. Three classes of human users are expected to make critical contributions to the system's performance: pilots, controllers, and system maintainers. This current version of the NEXCOM human factors plan focuses on the first segment of the FAA NEXCOM program and identifies human factors priorities for the 2002-2003 timeframe. The HFWG recommendations comprise a set of human factors activities focused on pilot, controller and technician functions and equipment, a sequence and timeline for their execution, and organization roles and responsibilities.

Products:

1. NEXCOM HF Roadmap

Major Milestones	Timeline
1. Write Flight Deck sections of NEXCOM HF Roadmap	Spring 2002 ♦
2. Coordinate drafts	Summer-Fall 2002 ♦
3. Sign off Final Draft	April 2003

Project 14: Required Navigation Performance (Kaliardos)

This work entails coordinating with Bruce DeCleene and Kathy Abbott. A roadmap of what needs to be done is being prepared by MITRE. The task here is to review the draft roadmap and provide feedback to ensure that human factors is adequately addressed as part of the this program. The second step is to

develop an implementation plan for the human factors aspects of the program, which will specify how the human factors issues will be identified and addressed. This roadmap will be coordinated with the AIR-130 Navigation team prior to final publication.

Products:
1. Input to RNP Roadmap
2. RNP Human Factors Roadmap/Implementation Plan (separate document)

Major Milestones	Timeline
1. Review RNP Roadmap (MITRE) 2. Work revisions to RNP Roadmap	April 10nd
3. Propose HF considerations to be added to RNP Roadmap	May 15
4. RNP Roadmap published	July 22
5. Intiate work on HF RNP Roadmap and Implementation Plan (Coordinate with AFS-400)	Aug 22nd
6. 1st draft of HF RNP Roadmap & Implementations	Oct 1st

Project 15: MSL-GSL Policy Memo (Kaliardos)

For the past two years ACO's have been waiting for cross-FAR part policy from AIR-130 to establish what will be acceptable to display in terms of altitude information. Specifically, several companies are proposing to display an MSL altitude that is derived based on GPS altitude information, which in some cases is blended with other altitude information. The question is will it be acceptable to display altitude information which may conflict with the approved altitude source. Currently the Transport Directorate position is that it is not acceptable to display this type of conflicting MSL information, regardless of how it is labeled. The rotorcraft policy is that the GPS derived altitude information may be displayed, provided it is not labeled as MSL. The Small Airplane Directorate policy is that the GPS derived altitude information may be displayed and may be labeled MSL. Obviously, this discrepancy needs to be resolved and appropriate policy needs to be issued. The focal point for this project is Shelia M. (AIR-130). Bill Kaliardos will provide human factors support, working closely with the other Human Factors Specialists, as well as with Guy Thiel and Kirk Baker.

Products:
1. Policy Memo

Major Milestones	Timeline
1. Review current draft policy memo	April 2003
2. Discuss issues with test pilots (Guy Thiel, Ralph W., Gene Arnold, etc.)	April 2003
3. Provide HF input and re-work policy memo	May 2003
4. Policy Memo Distributed for Coordination	May 2003
5. Comments Received	
6. Policy Memo Signed Out	June 2003

Project 16: Focal point for AAR-100 Flight Technologies & Procedures (Research). Coordination-provide input /recommended changes to database. (Gallaway)

The FAA's Research and Acquisitions Office of the Chief Scientific and Technical Advisor for Human Factors (AAR-100) funds approximately 8 million dollars worth of flight deck human factors research per

year. This money is distributed through a range of areas such as maintenance, general aviation, vertical flight, air carrier training. The area which sponsors projects of most direct relevance to AIR-100 is the Flight Technologies and Procedures Flight Technical Committee Requirements Group Requirements (TCRG). Glen Gallaway will coordinate the activities of that TCRG to ensure that AVR requirements are identified and processed in a timely manner.

Products:

1. Compiled list of AVR requested upgrades to AAR-100 research requirements database

	Major Milestones	Timeline
1.	Review AVR Requirements Document- which contains timelines and Roles and Responsibilities	February 20003 ♦
2.	Collect AVR requested upgrades to AAR-100 research requirements database	Feb 2003 ♦
3.	Submit requests to Kip Krebs	Feb 2003 ♦
4.	Schedule necessary TCRG meetings	April 2003
5.	Email TCRG members to advise them of steps, meetings, and timelines	April 4, 2003
6.	Discuss TCRG coordination role with George Marania & Tom McCloy	April 2003
7.	Provide additional AVR requested updates to AAR-100 research requirements database- check on status of unfinished items	April 2003
8.	TCRG Meeting- Review of FY 03 projects	May 2003 (? TBD)
9.	TCRG Meeting- Finalize FY 04 requests	August 2003 (? TBD)
10.	Continue coordination with McCloy, Marania, as well as TCRG members	Continuous.

Project 17: Lighting TSO Focal (Formerly Gallaway- Project transferred to AIR-120)

Glen Gallaway will be the sole representative for aircraft lighting in 2003 after Phil Ackers retires. Currently aircraft lighting is in conflict with night vision equipment. To correct this problem it was estimated that full-time labor was required. Required actions for 2003 are listed below.

Products:

1.

	Major Milestones	Timeline
1.	Put together information package in preparation for FAA/SAE meeting	March 2003 ♦
2.	Participate in 2 yearly meetings as FAA's representative	TBD- AIR-120 staff
3.	Attend 1 week lighting class	TBD- AIR-120 staff
4.	Read/learn all documentation on the topic	TBD- AIR-120 staff
5.	Learn job and responsibilities	TBD- AIR-120 staff

Project 18: ELT TSO Focal (Kaliardos)

TBD-Bill Insert Wording Here.

Products:

1. Letter to reply to NTSB
2. Issue Paper - FAA Position on ELT

Major Milestones		Timeline
1.	1st meeting NSARC R&D Working Group	Jan. 29, 2003
2.	Draft reply to letter to NTSB	Feb. 14, 2003
3.	Final letter to NTSB	Feb. 21, 2003
4.	2nd Mtg NSARC R&D Working Group	May 2003
5.	Issue paper- FAA position on ELT	June 2003

Project 19: Avionics Workshop Support With Making Workshop CD ROMS
(Gallaway)

Every year the AIR-130 groups hosts an FAA Avionics Standardization Workshop. A CD ROM is generated for distribution to workshop participants which contains the workshop presentations and related policy. The tasks remaining to be completed for last years workshop include

1. Develop a specification for presenting the material from the August 2002 workshop on a CD
2. Develop a list of presentations and presenters at the August 2002 workshop
3. Check with each presenter to ensure that the presentation we have is the correct version and does not contain any proprietary information
4. Organize the presentations into folders based on topic areas, according to the agenda
5. Prepare a word document listing the names of the presentation files and presenters- note we had some presentations that were asked to be included on the CD which were not presented in person at the August 2002 workshop. Additionally, some speakers used more than one file per presentation
6. Prepare a word document to map the presentations with the related policy documents also on the CD ROM.
7. Work with Michelle to finalize the CD specifications and arrange purchase and preparation of the CD
8. Prepare mailing labels to mail the CDs
9. Mail the CDs

Products:

1. August 2002 Avionics CD ROMs with presentations and related policy

Major Milestones		Timeline
1.	Specifications for CD completed	January 22, 2003
2.	Specifications discussed with Michelle Swearingen	March 29, 2003
3.	Double check completed- to confirm that all presentations are the correct version and that the presentations do not contain proprietary information	In process. Will be sent to original authors for scrubbing. April 11, 2003. Returns expected 4/25/03
4.	Contract established to burn CDs	
5.	Material to be put onto CD ROM shipped to appropriate contract company	
6.	CD Roms completed	
7.	CD ROMs mailed out to presenters	June 30, 2003

Project 20: Get Up To Speed on Core Documents (Gallaway & Kaliardos)

This task entails mastering the basic literature related to this job. This includes mastering a cross section of core human factors policy memos, reports, and Notices, as well as other FAA Orders, Advisory Circulars, and other documents. Items 1 through 10 must be thoroughly understood. Item 13 is required for Bill Kaliardos. Items 14 and 15 are required for Glen Gallaway. The remaining items should also be mastered, but need not to the same level of proficiency. Several of these documents were distributed prior to the interviews and reviewed again in an HF team meeting within the first two months on the job. These documents should be mastered no later than 8 months from employee start date.

Core documents directly related to Human Factors:

1) FAA Notice 8110.98 Addressing Human Factors/Pilot Interface Issues of Complex, Integrated Avionics as Part of the TSO Process
2) Public Statement Number PS-ACE100-2001-004 on Guidance for Reviewing Certification Plans to Address Human Factors for Certification of Part 23 Small Airplanes
3) Policy Statement No. ANM-99-2, Guidance for Reviewing Certification Plans to Address Human Factors for Certification of Transport Airplane Flight Decks.
4) Policy Statement No. ANM-01-03, Factors to Consider When Reviewing an Applicant's Proposed Human Factors Methods for Compliance for Flight Deck Certification.
5) Federal Aviation Administration Human Factors Team Report on: The Interfaces Between Flight Crews and Modern Flight Deck Systems

Other core FAA documents:

6) Description of the FAA Avionics Certification Process (James H. Williams paper)
7) AC 23.1311-1, Installation of Electronic Displays in Part 23 Airplanes.
8) AC 25-11, Transport Category Airplane Electronic Display Systems.
9) AC 25.1523-1, Minimum Flightcrew.
10) Order 8150.1B, Technical Standard Order Program.
11) AC 27-1, Certification of Normal Category Rotorcraft.
12) AC 29-2, Certification of Transport Category Rotorcraft.
13) AC 120-76A, Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices (required for Kaliardos)
14) TSO-C153, Integrated Modular Avionics Hardware Elements. (required for Gallaway)
15) AC 20-145 Guidance for Integrated Modular Avionics (IMA) that Implement TSO-C153 Authorized Hardware Elements (required for Gallaway)
16) AC 25.1309-1, System Design Analysis.
17) AC 23.1309-1, Equipment, Systems, and Installations in Part 23 Airplanes.

Other:

18) RTCA/DO-257, Minimum Operational Performance Standards for the Depiction of Navigation Information on Electronic Maps.
19) "Guidelines for the Design of GPS and Loran Receiver Controls and Displays," Technical Report DO/FAA/RD-95/1, March 1995.
20) "Human Factors for Flight Deck Certification Personnel," Technical Report DOT/FAA/RD-93/5, July 1993. Copies of document #18 & #19 may be ordered from the National Technical Information Service (http://www.ntis.gov/).

APPENDIX A
Summary of Communication Navigation Surveillance (CNS) HF Work

Communications (Wade)

	Type of Document	Topic	Focal Point
1.	Policy Memo, MOPS, AC 20-FIS	Weather Displays	Donovan
2.	HF Roadmap	NEXCOM	Donovan*
3.	AC 20-DC ??	Controller Pilot Datalink Communications (CPDLC)	(Herschler?)*
4.		Controller Pilot Datalink Communications (CPDLC)- American Airlines Cert. project	(Herschler?)*

Research funded FY 03:
1. NEXCOM Research project funded by AUA*

**These tasks are not being supported at this time*

Navigation (DeCleene)

	Type of Document	Topic	Focal Point
1.	AC 90-RNP	Required Navigation Performance	Kaliardos
2.	RNP Roadmap		
3.	HF RNP Roadmap/Implementation Plan		
4.	MOPS & TSO	Moving Map	Donovan
5.	AC	Electronic Flight Bag	Kaliardos

Research funded FY 03:
1. Moving map research
2. RNP research funded in FY 02 and requested for FY 05

Additional Notes:
1. In support of the RNP tasking and to get an understanding of related issues Bill Kaliardos will be attending some of the ATA FMS Task Force meetings and SOIT meetings.
2. Colleen Donovan will be attending the SC-181 WG4 meetings (Moving Map MOPS)

Surveillance (Passman)

	Type of Document	Topic	Focal Point
1.	AC	ADS-B CDTI	Kaliardos

Research funded FY 03:
1. ADS-B CDTI alerting research funded by AAR-100
2. ADS-B CDTI work funded by AND-510

Additional Notes:

1. Bill Kaliardos will be attending only a sampling of SC-186 meetings, since their documents will not be the basis for the AC work. Attending meetings will be focused on gathering information and contacts.

APPENDIX B RESEARCH REQUESTS

This appendix contains research requested by the AIR-100 Human Factors Specialists (including Colleen Donovan, Bill Kaliardos, and Glen Gallaway as well as Dr. Kathy Abbott). Not all research requested gets funded. Requests must be submitted three years in advance, due to the congressional funding and budget cycle. Additional information is available about any project that has been funded. The table below reflects a list of titles. The following pages contains the actual research request. AAR-100 gets to determine which research organization gets each project (and the associated money). In addition to this research, AND funds human factors research requested by us on the NEXCOM program (noted in the NEXCOM Human Factors Plan, which Matt Wade has a copy of). We've also requested AND Safe Flight-21 for the ADS-B/CDTI work, which Bob Passman has a copy of.

This appendix contains excerpts from the Human Factors AAR-100 database (www.hf.faa.gov/db) which is currently in the process of being updated. Some requirements will be combined, others will be deleted. Thus, it is recommended that the reader only scan through this appendix.

Generally sponsors request research that will be beneficial to the projects and policy they are developing. Thus, the AIR-130 focal points have sponsored the following types of research:

- Kaliardos= EFB, RNP, & ADS-B/CDTI
- Gallaway = multi-function controls
- Donovan= moving map, job aid, & WX

Research Project Title	Sponsor	Funding Notes	Related To
1. Electronic Flight Bag	Kaliardos	Funded FY03-04	EFB
2. Electronic Maps: Panning, zooming, rotating, and decluttering	Kaliardos	?	EFB
3. Evaluation of Situation Awareness as an Intended Function	Kaliardos	Requested for FY 05	
4. Graphic Presentation of Human Factors Information in Acs, Guidelines, and Other Documents	Gallaway	Requested for FY 05	
5. HF Information Support Center- Internet WEB-Site Delivery System Architecture & Design Requirements	Gallaway	Requested for FY 05	
6. HF Knowledge Central- Framework for finding/applying HF knowledge in certification process	Gallaway	Requested for FY 05	
7. Highway in the Sky/Synthetic Vision	Donovan	Requested for FY 04	NAV
8. Human Factors Issues with ADS-B	Kaliardos	Requested for FY 05	SURV
9. Integrated Modular Avionics (IMA)	Gallaway	Requested for FY 05	IMA
10. Multi-function controls	Gallaway	Requested for FY 03	IMA
11. Multi-function display/controls	Donovan	Completed	
12. Traffic Display Alerting (ADS-B) issues	Donovan & Kaliardos	Funded FY 03	SURV
13. Vertical Navigation/RNP Displays/Symbology	Donovan	ICAO Symbology Funded FY 03. Other tasks completed.	NAV
14. Weather Displays	Donovan	Funded FY 03	COMM
15. Error Management	Abbott	Funded FY 01-03	
16. Human Factors Guidelines for Instrument Procedure Design	Abbott	Funded FY 01-03	
17. Human Factors Job Aid	Abbott & Boyd	Funded FY01 -04	

Specific Research Requests Grouped by Author

Flight Technologies and Procedures

Requirements

Requirement ID: 900 Special Category: NONE

Sponsor Organization: AIR Sponsor POC: Colleen Donovan - Kaliardos

Keywords: Alerting Systems, Annt/Mental Models/Cognition, Automation, Decision Making, Errors, Interface Design, Performance (meas/imprv), Safety, Situation awareness (SA), Workload

Title: Traffic Display Alerting (ADS-B) Issues

Research Statement:
Human factors research is needed to provide a capability for certification personnel to evaluate alerting functions on ADS-B traffic displays. Specifically on developing and validating criteria for constraining false and nuisance alerts for cockpit display of traffic information avionics.291

Background:
The objective of this project is to develop and validate criteria for constraining false and nuisance alerts for cockpit displays of traffic information (CDTI), based on what is known about other alerting algorithms (ex. TCAS) and human performance issues with alerting systems, trust, situation awareness and workload. Where objective criteria are not possible, subjective means may be recommended provided they are established to be reliable and valid measures. These criteria are to be included as minimum requirements in the RTCA Minimum Operational Performance Standards document or an FAA Technical Standard Order for CDTI. Both of these documents are used by avionics manufacturers to develop their systems, and FAA aircraft certification specialists who evaluate the systesm. The project should be focused on developing these objective and subjective measures as minimum certification criteria, based on research and data, for approving the Free Flight technologies known as Cockpit Displays of Traffic Information (CDTI). The CDTIs may be either stand-alone units or as part of an integrated ADS-B CDTI/Traffic Collision Avoidance System (TCAS). This research will span a period of three years, with three distinct phases. Each phase may be considered individually for support, but the latter phases will depend on successful completion of the previous phases. Phase 1 and the first year efforts will focus on data gathering and understand how similar issues were solved with other flight deck alerting systems, such as TCAS, enhanced ground proximity warning systems (EGPWS) and wind shear alerts. This phase will include exhaustive review of the certification standards, requirements and guidelines related to false alerts and alerting criteria published in RTCA MOPS and TSOs for the systems mentioned above. The background and basis for the currently published standards should also be examined, as well as research literature pertaining to human performance issues with alerting systems associated with situation awareness, trust, and workload. The interactions of these constructs will also be examined, with an objective of identifying common underlying structures or mechanisms. This will include a review and evaluation of the Aviation Safety Reporting (ASRS) literature associated with TCAS problems, as well as other TCAS issues in order to uncover lessons learned. Special emphasis will be paid to the three “key references” listed at the end of the paper, as a potential means to develop certification standards to enable the evaluation of traffic collision alerting systems (e.g., CDTI ADS-B, TIS, and TCAS). These key reference papers propose the use of Signal Detection Theory (SDT) methodology as a means to evaluate alerting systems and separate the impact of various decision biases. SDT can be used to study the impact of changes to the decision threshold, and also the impact of changes to the a priori base rate events in the real world. The authors of these key references establish the importance not only of high hit rates and low false alarm rates, but also of the importance of high posterior probabilities of a true alarm. Additionally, they also propose a means to access the impact of these changes, despite the fact that only a handful of airplanes are equipped with ADS-B/CDTI systems, and thus it is difficult to determine the base rate information for these events, which is required to determine the posterior probabilities. Thus, one path of pursuit towards objective criteria to evaluating the CDTI alerting system is by attempting to apply the methodologies proposed and developing recommended certification criteria for the alerting systems hit rates, false alarm rates, and posterior probabilities. This methodology may prove effective in developing objective criteria for evaluating the appropriateness of an alerting system on the “trust/use/misuse/abuse” dimension. Additional methodologies and criteria would need to be developed to evaluate the situation awareness and workload dimensions. Task 1: Documentation review: understanding the problem, determining what certification standards and alerting criteria exist for other alerting systems, in an effort to capitalize on lessons learned when developing minimum certiciation standards and criteria for CDTI alerting algorithms. 1) Obtain TCAS RTCA MOPS and TSO, as well as WAAS (RTCA DO-119B), enhanced ground proximity warning system (EGPWS), and wind shear. From each document, review sections on human performance/human factors alerting and false alert rate criteria and alerting algorithm. What is the criterion for a hit and false alarm? What studies are referenced to justify/explain the basis for the standards and criterion. Focus on alerting

sections of all documents. 2) Identify TCAS researchers, software developers, etc to understand what had been done, why certain criteria were selected, and understand the alerting problems experience over the years with TCAS. Currently, the TCAS standards, and thus the TCAS avionics, have been revised seven times (we are now on TCAS Version 7) and an eighth version may be in the works. You will need to understand what, why, and how changes occurred to the alerting thresholds from version 1 - 7. What false alert problems did they have with the various versions, what was the impact on the operators (human performance issues that made the updates necessary) 3) Review ASRS database or any other database that contains TCAS incidents over the years (from the early versions of TCAS to modern day systems). Compile a list of human performance issues with versions of TCAS and associated key incidents/accidents that made the changes/updates required. Summarize what went wrong, was it corrected with a new version? What alerting issues exist today. What can we extract from this data to help us develop appropriate criteria for CDTI and other alerting systems. 4) Compare and contrast TCAS and CDTI alerting algorithms, functions, capabilities. What aspects of the TCAS alerting algorithms/criteria can we use directly for CDTI, what needs to be modified. Make recommendations for how we should move forward on developing certification standards to ensure we don't approve systems with these problems again (ex. Should we specify the CDTI alerting algorithms in the MOPS? Should we specify constraints on the false alert rate, as they do in the WAAS MOPS (RTCA DO-229B)? Recommendations for what those constraints might be for CDTI? 5) Identify CDTI researchers and software developers to determine how much human factors input has influenced algorithm. Did they incorporate lessons learned from TCAS? (note: I think this is part of item 2 – suggest combining it in the step above) (I put this as part of step 1 since it should help them get a sense of the types of requirements we are trying to end up with- or hopefully, something even better) Year 2 1) Signal detection research and/or simulations to investigate what might be appropriate minimum certification criterion to constrain the false alert problem and/or develop/refine the alerting algorithm. Conduct signal detection simulations, similar to Kuchar's work on TCAS, to examine false alarm rates for CDTI. Also see paper by Krois to refine research/simulations. 2) Validate simulations in human subject experiment using MITRE's CDTI lab to determine whether the proposed alerting threshold/algorithm is appropriate for the cockpit alterting system. Test multiple scenarios in order to evaluate the algorithm in a range of operational tasks where TCAS had problems and CDTI might have problems. Year 3 1) Investigate air-to-ground alerting systems, applying lessons learned and methodologies developed in years 1 and 2.

Output:
1. Documentation review: a) empirical human factors results relevant to alerting systems, available in the public domain (journal articles, conference proceedings, and government reports); b) certification standards, requirements and guidelines related to false alerts and alerting criteria published in RTCA MOPS and TSOs for cockpit alerting systems; c) comparison of the alerting algorithms of TCAS, CDTI, CA, and URET d) previous ASRS analyses on alerting system related incidents to determine if yet another ASRS analysis is warranted; e) literature on human factors certification for guidelines for development of certification criteria for CDTIs; f) identification of other data sources (e.g., from demonstrations and simulations or from operational environments) that would allow for further examination of relevant human factors issues outside of a laboratory. 2) Examination of the roles of cockpit alerting systems. This subtask will examine the roles of a number of automatic alerting systems (GPWS, TCAS, wind shear alert) and the impact of these on the respective certification criteria of the alerting systems. 3) Development of measures and criteria for collision avoidance system evaluation. This subtask involves a comprehensive evaluation of available measures of machine, human, and human-machine system performance as they pertain to collision avoidance systems, identification of primary and secondary measures, and evaluation of empirical support for the latter. 4) Develop designs and protocols for experiments. Based on findings from the literature review, we will develop experimental designs and protocols aimed at investigation of the most critical issues relevant to human factors certification of CDTIs and to address possible controversies in the alerting system literature.

Regulatory Link:
Surveillance (ADS-B/CDTI) Advisory Circular.

Flight Technologies and Procedures

Requirements

Requirement ID: 621

Special Category: NONE

Sponsor Organization: AIR

Sponsor POC: Colleen Donovan

Keywords:

Title: Vertical Navigation/RNP Displays/ Symbology

Research Statement:
Human factors research is needed to support development of minimum certification requirements and guidelines for the approval of new moving map displays depicting surface situation awareness, vertical profile navigation information, and required navigation performance. This also includes the need for research to evaluate and identify human factors issues with symbology being proposed for use on these displays to support the ICAO symbology committee intending to standardize these symbols. Minimum certification requirements and guidelines is intended to go into an RTCA SC-181 MOPS, an FAA TSO on moving map RNP/RNAV vertical navigation displays, and the symbology results will feed into an ICAO document. 714

Background:
New moving map displays are being proposed for certification. These displays include information that is for situation awareness. It is important to understand the potential impact of this information on the pilot, as well as determine what certification requirements are appropriate. The research is needed to facilitate aircraft certification specialists in the identifaction and resolution of human factors/pilot interface issues with new moving map displays including required navigation performance displays, vertical profile situation awareness displays, and surface situation awareness (airport surface map) displays being proposed by manufacturers such as Honeywell, Rockwell Collins, Avidyne, Smiths, Sandel, etc. This guidance should include certification minimum requirements and design guidance, based on research and usability assessments of new and emerging display systems.

On-Going Project Entails: Vertical Navigation display work- guidelines and recommended practices for display manufacturers and to certify the equipment. Issue: many avionics vendors are working on developing vertical navigation and/ or 3-D displays- need a literature review of existing material- produce summary guidelines and minimum certification requirements. Research program should entail experimental testing of displays that simultaneously present top down (plan) and side ways (profile) views- similar to the two views on instrument approach charts. Additionally looking at either display mode alone. Look at issues related to Boeing vs. Airbus use of colors when these displays are combined with terrain and/or weather. Pay attention to depiction of RNP information (RNP bubble, status, and alerting) particularly on vertical dimension. Primarily avionics research to support AIR in the revision of the moving map MOPS/TSO to include requirements for RNP displays with vertical guidance. Provide recommendations for what works and doesn't work in GPS/RNAV/VNAV displays. Multi- year program.

Additional related tasks: Examination and evaluation of depicting ICAO vs. SAE recommended symbology in electronic format. Issues with depicting that symbology on low-end GA displays and also on vertical navigation displays. Discriminability of symbols.

Conduct research to resolve path mode issue in profile displays applied to the RNP environment and develop application to certification tool. Deliverables: Research Report; Certification tool for evaluation of path mode representation in profile navigation displays.

Priority: Priority Criteria: Internal= 3 Human Factors Guidance to support development of RTCA MOPS & FAA TSO on moving map RNP/RNAV vertical navigation display.

Reduce Accidents= 2 (Useful)

External= 3 (Important- The program supports resolution of safety issues required to develop policy as identified in REDAC, ARAC, RTCA, etc, Committees. NOTE: RTCA);

New Technology= 3 (Support for new technology= Important- "allows FAA/AVR to respond in a timely fashion with solutions or procedures for expected new technology")

Output:
Industry Review Report. Report documenting results of usability assessment, with human factors/pilot interface issues, requirements and design guidelines.

Regulatory Link:
Moving Map TSO and RTCA DO-257 update.

Flight Technologies and Procedures

Requirements

Requirement ID: 619 Special Category: NONE

Sponsor Organization: AIR Sponsor POC: Colleen Donovan

Keywords: Interface Design, Situation awareness (SA), Weather

Title: Weather Displays

Research Statement:
Human factors research is needed to develop minimum certification requirements and recommendations for evaluating the depiction of weather information on flight deck displays as well as to develop a certification usability assesment methods/tool. 248

Background:
A plethora of new weather information is being proposed to be depicted in the flight deck that was previously only available on the ground. This includes real-time graphical information such as graphical metars, winds aloft, precipitation, and NEXRAD data. Concerns about how this information is presented, in isolation and combination, have been raised. Questions such as 'when is the data too old and needs to be removed from display, how is the age of the data depicted? Does it need to be depicted? What about merging data of different ages on the same display, different orientations (north-up vs. track up) displayed concurrently? Color issues, symbology issues? Depicting this information concurrently on a display with non-weather data?

Research is needed to identify the current and emerging human factors pilot interface issues and to develop appropriate requirements and guidelines for the Aircraft Certification Specialists who must evaluate and approve these systems. This guidance should include certification minimum requirements and design guidance, based on research and usability assessments of new and emerging weather displays, regardless of the platform (multi-function display systems, electronic flight bag, etc.). *On-Going Project Entails:*

Update to previously submitted industry product review- including review of existing design conventions. Review of draft weather display requirements and recommendations (in DO-267 and FIS-B advisory circular). *Outyear work:*

1) Usbility assessment of avionics to determine current human factors/pilot interface issues with existing and prototype systems, in order to develop minimum certification requirements for the approval of these systems.

Outyear work:

Priority: Internal 3= Imporant= "implement JSITs"

Potential to Reduce: 4= Program responds to immediate aviation issues that have direct operational safety impact and is identified in an approved JSIT. Note: GA Weather JSIT identified the need for weather displays in the cockpit and streamlined certification of these avionics. Recommendation 1: Provide better information to pilots on the location and severity of weather hazard areas, and better methods of using weather information to make safe decisions on how and when to make a flight.

The greatest proportion of fatal, GA weather accidents can be eliminated by implementing the functional group of interventions contained within this recommendation as a group.

; Produce, and make operational, graphical weather information products that show how and when flights can be made

safely.

; Improve the PIREP collection / dissemination system with a common database for controllers, pilots, FSS specialists and dispatchers.

Improve certification to accelerate the equipage of GA aircraft with low-cost avionics for data-link display of weather graphics."

External: 2= Useful

New Technology: 4= The program is required to support development of FAA/AVR policy, rules, TSO's, AC's. Note: work required to support new weather display TSO (via RTCA document) and advisory circular. WX will be data linked up. Certification part of Capstone avionics package.

Output:
1) Industry review product report. 2) Usability assessment report documenting potential issues. 3) Issues list which certification specialists can use to develop certification issue papers. 4) Edits/recommendations to draft requirements and guidelines (DO-267 and FIS-B Advisory Circular).

Regulatory Link:
FIS-B Advisory Circular, new weather displays Technical Standard Order (draft) and RTCA DO-267A (to be referenced by TSO)

Flight Technologies and Procedures

Requirements

Requirement ID: 808

Special Category: NONE

Sponsor Organization: AIR

Sponsor POC: Colleen Donovan

Keywords:

Title: Highway in the Sky/Synthetic Vision

Research Statement:
Research is needed to invesigate human factors/pilot interface issues with proposed highway in the sky and synthetic vision systems proposed by Universal Avionics, NASA, Rockwell Collins, and others in order to assist the aircraft certification specialist identify and resolve (determine acceptable means of complaice) with these issues.337

Background:
Aircraft certification specialists are currently being asked to review and approve new highway in the sky/synthetic vision systems, which may be "for situation awareness only" but be placed in a compelling area of view, such as the pilots primary field of view. This includes the Universal avionics system, the NASA system, and a Rockwell Collins system with functionality well beyond what has been approved in the past. Serious potential consequences may arise if the aircraft specialists approve something that should not be approved. To date the FAA has no published guidance on human factors issues with these types of systems in order to determine what is acceptable and what is not. This material needs to be data driven and research is need to identify potential issues and resolutions.

Output:
1) Research report documenting potential human factors/pilot interface issues.

2) Issues list- to be used for generating aircraft certifcation issue papers 3) Industry Product Review - including descriptions of what is being developed and presented by industry in this area

Regulatory Link:
AC 25-11 and 23.1311-1A (both are about to be updated, and should include appropriate guidance material for synthetic vision systems)

Flight Technologies and Procedures

Requirements

Requirement ID: 639 Special Category: NRC

Sponsor Organization: AIR Sponsor POC: Bill Kaliardos

Keywords: Interface Design, Situation awareness (SA), Training-Other, Workload

Title: Electronic Flight Bag

Research Statement:
Human factors research is needed to provide certification (AIR), operational approval, and training (AFS) guidance, including input to AC's, as well as to mitigate risks associated with the implementation and integration of electronic flight bags on the flight deck. One goal is to develop and test methodology for evaluating EFB usability for Certification and Flight Standards Work should be in three sub-task areas: Task 1: Finish/update the "Human Factors Considerations for the Design and Evaluation of Electronic Flight Bags, Version 2" document Task 2: Develop a WEB/HTML/Hypertext version to facilitate ease of document use Task 3: Develop EFB Evaluation methods and tools for AIR & AFS to use during certification and operational approval, to ensure HF/pilot interface issues are identified, documented, and resolved. Note: High Priority- this work was flagged by AVR-1 as critical907

Background:
EFBs typically consist of a screen and controls in a self-contained unit that is relatively small weighing only a few pounds. They can be hand-held portable devices or mounted in the flight deck. They may be passive display or interactive, and can stand alone or connect to on-board and/or ground systems. Aircraft certification specialists are currently being asked to review and approve new electronic flight bags including complex integrated electronic checklists with functionality well beyond what has been approved in the past. Serious potential consequences may arise if these specialists approve something that should not be approved, as some of these systems have cursor control devices controling aircraft systems (engines etc.). The FAA is working on an advisory circular which is intended to contain guidance on the identification and resolution of human factors/pilot interface issues with these types of systems in order to determine what is acceptable and what is not. This material needs to be data driven and research is need to identify potential issues and resolutions. EFB Includes work on evaluating systems (e.g., Northstar & Avionitek)to gather data. Explore developing a generic interface philosophy document to help standardize look & feel of all applications (as Microsoft does with the design guide/philosophy document). Requires working with appropriate ATA and SAE committees, potential airline users, and avionics vendors. Joint AFS/AIR need, since an EFB may require both operational and airworthiness approval(could be plug in laptop or built in system hard-wired to the airplane). Do a usability assessment of currently fielded and potential EFB systems in order to evaluate the issues with these systems. This should include an evaluation of the prototype systems being developed by United Airlines and others. All features functions of these units should be evaluated from a human factors perspective and initial data should be collected from subjects to assess the potential errors with these systems and their consequences. Results should be fed into revisions to the document and associated FAA AC.

Output:
Electronic Flight Bag- FY 03. Task 1 output: Update to Volpe Document (currently referenced in FAA AC 120-76) "Human Factors Considerations for the Design and Evaluation of Electronic Flight Bags, Version 2". Update will include revisions to ensure: 1) document is consistent with newly updated EFB AC, 2)comments from technical sponsors are addressed, 3) document structure optimized for ease of end reader/user- based on input from EFB Northstar evaluation, and 4) updated industry review appendix. Update will also include a new quick reference evaluation checklist appendix. Task 2 output: WEB/HTML/hyperlink version of the "Human Factors Considerations for the Design and Evaluation of Electronic Flight Bags, Version 2" document to facilitate ease of use by three target audiences (pull up chapter/issues on: equipment, training/procedures, or instalation issues without having to go through the full 150 pages. Task 3: EFB Evaluation Methods and Tools for AIR & AFS. Product 1 for AIR: Quick reference checklist developed for the version 2.0 document should be tested and refined. Comprehensive EFB human factors/pilot interface issues list will be developed, to serve as the basis for Certification Issues Papers. Thus ensuring the issues on certification projects are appropriately addressed and documented. Product 2 is a quick reference equaluation list for AFS (including the Airplane Evaluation Group- AEG) evaluations of EFBs.

Regulatory Link:
Advisory Circular 120-76

Flight Technologies and Procedures

Requirements

Requirement ID: 901

Special Category: NONE

Sponsor Organization: AIR

Sponsor POC: Bill Kaliardos

Keywords: Annt/Mental Models/Cognition, Cabin Crew, Errors, General Aviation Pilots (GA), Interface Design, Performance (meas/imprv), Situation awareness (SA), Task Analysis / Models, Workload

Title: Electronic Maps: Panning, zooming, rotating, and decluttering

Research Statement:
Research is needed to understand the safety implications of the four basic display manipulation functions: panning, zooming, rotating, and decluttering. One or more of these display functions are critical to nearly all electronic depictions of the environment--loosely defined here as an electronic "map." This includes standard aeronautical maps and charts, as well as depictions of traffic, weather, and terrain.416

Background:
The design and certification of display manipulation functions tends to be ad hoc, despite that these same functions are ubiquitous on electronic depictions of the environment. The electronic depiction of information--which was traditionally obtained via paper or other physical mean--offers obvious benefits, but also introduces potential human factors safety problems when (literally) navigating this information on a display. Unlike paper maps, for example, in which the manipulation states are intuitive and immediate (e.g., it's quick and easy turn a map 45 degrees, and unlikely to lose track that it is being held in that position), electronic maps may be slower, discontinuous, and may not effectively communicate the controlled manipulation state. The result can be excessive workload or errors in understanding display information. The four display manipulation functions--panning, zooming, rotating, and decluttering--are considered together not only because they are common requirements of displays, but because their states have common control issues to consider, such as: 1. Active versus automated manipulation (e.g., moving map or automated decluttering) 2. Returning to default settings (e.g., standard zoom), especially when the default is not static (e.g., changes with flight phase) 3. Intuitive and standardized controls for manipulation 4. Feedback of current manipulation states (e.g., current zoom level) 5. Workload associated with display manipulation 6. Controlability (speed, latency, continuity, overshoot and stability) In order to have the widest impact, this research should not be application-specific. However, it can use currently developed technologies and applications in order to generalize appropriately to other application-specific aircraft displays.

Output:
1. Review of current research literature 2. Safety and performance assessment of display manipulation functions currently used 3. Human factors guidance to assist designers and certification policy developers

Regulatory Link:
Electronic Flight Bag AC120-76, Moving Map TSO

Flight Technologies and Procedures

Requirements

Requirement ID: 898

Special Category: NONE

Sponsor Organization: AIR

Sponsor POC: Bill Kaliardos

Keywords: Annt/Mental Models/Cognition, Decision Making, Errors, General Aviation Pilots (GA), Interface Design, Safety, Situation awareness (SA), Workload

Title: Evaluation of Situation Awareness as an Intended Function

Research Statement:
Human factors research is needed to provide guidance for the certification of flight deck devices whose function is claimed to be for "situation awareness." It is hypothesized that some of these devices are compelling to use beyond situation awareness, and can adversely affect flight deck decision making. Research will develop a database of such evidence, and propose explanations based on an analysis of flight deck decision-making. Based on this understanding, a resolution for the certification process will be proposed.528

Background:
Many applicants develop flight deck information tools that are to be used "for situation awareness only." Examples are compelling displays such as: * moving charts with own-ship * enhanced/synthetic vision * highway-in-the-sky * perspective terrain display * traffic information display * weather display From a certification standpoint, the label of "situation awareness" (SA) has provided applicants with a means to maintain a purposely vague description of intended function, resulting in a less-costly certification path. SA-based arguments assert that the pilots don't really do anything significant with the information that the displays provide. In contrast, we assert that: 1. Pilots in fact can significantly alter their decision-making based on SA devices 2. The altered decisions are sometimes unsafe 3. Cognitive workload is sometimes increased, such as when integrating a device's information with the other flight deck information (e.g., when altitudes from different sources don't agree). To support these hypotheses, research will perform an inventory of previous cases in which "situation awareness" was the intended function. These cases will be analyzed to understand the issues raised during the certification process, and to understand the specific ways in which flight deck decisions might be altered. Where possible, experimental data from flights will also be used. We expect to not only find data that clearly supports our hypotheses, but also expect to explain and predict pilot behavior. This, in turn, can provide certification specialists with the necessary grounds for preventing the approval of unsafe situation awareness tools.

Output:
1. Inventory of previous certification cases in which the function was claimed as "situation awareness." 2. Analytical framework for predicting problems in situation awareness functions 3. Guidance material for certification specialists

Regulatory Link:
Regulation 25.1301 and equivalents (23.1301, 27.1301, 29.1301). May propose cross-FAR AC or policy memo to facilitate field reviews of SA displays

Flight Technologies and Procedures

Requirements

Requirement ID: 899 Special Category: NONE

Sponsor Organization: AIR Sponsor POC: Bill Kaliardos

Keywords: Air - Ground, Alerting Systems, Annt/Mental Models/Cognition, Automation, Culture, Decision Making, Errors, General Aviation Pilots (GA), Interface Design, Safety, Situation awareness (SA)

Title: Human Factors Issues with ADS-B

Research Statement:
Human factors research is needed to provide a capability for certification personnel to evaluate traffic displays that use ADS-B technology.140

Background:
Cockpit displays of traffic information (CDTI) are currently being developed as a situation awareness tool based on ADS-B technology. This new era of traffic displays has the technology to greatly improve upon traditional traffic displays such as TCAS, which has well-accepted (but perhaps outdated) guidance for interface design. However, almost no human factors guidance exists to exploit new ADS-B technology and the lessons learned from previous CDTIs. Data-driven research is needed to provide the appropriate guidance to certification personnel. Phase One of the research will establish the current state of CDTI knowledge from research literature, previous designs and certification efforts, current fielded systems, and current design efforts. This effort includes both literature reviews and informal discussions with key contributors. Literature reviews will involve collecting issue papers from ADS-B CDTI projects, literature from manufacturers, guidance from FAA, JAA, and standards committees, as well as publications from the academic community. Undocumented knowledge will likely need to be elicited to understand the design rationale behind many existing designs, since it is believed that many design efforts have been intuitively guided. The background research for ADS-B CDTIs will be extended to TCAS displays in order to extract the lessons learned from these ubiquitous systems. Phase One research will also involve the generation of an avionics inventory, in which specifications for all manufactured designs are identified and collected for analysis. Hands-on evaluation by human factors specialists is encouraged when developing this inventory. Once the current state of knowledge is established, Phase Two of the research will focus on analysis. A key goal in Phase Two is to identify the strengths and weaknesses of the systems studied during Phase One, via theoretical and experimental analysis. Experimental data should be generated not only from simulations, but also from jump seat observations (by human factors specialists), from interviews with users, and from hands-on evaluation by human factors specialists. At the human-machine interface level, the human factors issues that need to be studied include: symbology and phraseology; integration with TCAS; representation of mixed equipage, intent, directionality, navigation errors, coordination with other aircraft (automation), vertical states, panning/zooming/rotating/decluttering, alerting, continuous/automated/manual information display, workload, procedures and workflow. In particular, the analysis of alerts should build upon the lessons learned from TCAS, EGPWS, and other flight deck alerts, and the research should quantitatively analyze threshold logic using signal detection theory and other probabilistic tools. The designs analyzed in Phase Two should be considered in the context of a complex environment characterized or influenced by: applications (e.g., enhanced conflict detection, enhanced visual approach), location (e.g., terminal vs. enroute, airborne vs. surface), international harmonization, crew expertise, flight deck integration, and ATC integration (e.g., shifts in functionality and accountability between flight crew, air traffic controllers, cockpit automation, and ATC automation). In short, an appropriate analysis should consider not only the CDTI variables, but also the bigger picture of the world in which it operates. Phase Three will propose solutions or directions for future work related to human factors certification of ADS-B traffic displays.

Output:
Summary of current CDTI state of knowledge: Current requirements and guidance; Current ADS-B display systems (avionics inventory; Projected designs and applications. Analysis Summary: Key safety-related design issues and trades; Shortcomings of current guidance; Solutions and Future Work: Suggested requirements and guidance for improving safety; Suggestions for future work;

Regulatory Link:
ADS-B AC

Flight Technologies and Procedures

Requirements

Requirement ID: 896 Special Category: NONE

Sponsor Organization: AIR Sponsor POC: Glen Gallaway

Keywords: Communications, Documentation, Interface Design

Title: Graphic Presentation of Human Factors Information in ACs, Guidelines, and Other Documents

Research Statement:
Develop guidelines for use of graphics and formatting to improve the readability/usability of our FAA documents (ACs, TSOs, etc.) and FAA reports. Note: This is recommended as a small CSERIAC search ($5 K or less).216

Background:
A great deal of human factors information deals with tangible (and visual interfaces between people and an aircraft (displays, controls, environment, presented information, etc.). Many FAA documents present this human factors information in a text only format. This text presentation is an attempt to use words to describe a visual image. Creating an effective, accurate text translation of an issue is time consuming, difficult, and error prone. To find issues in text it is necessary to read the full text and separate it from the support verbiage. Then one must translate the text back into a visual image for processing. This processing is supposed to lead to understanding of the issue, but this second translation can potentially introduce a second misinterpretation of the issue. Human factors handbooks, training material, standards documents, and other media have effectively employed graphics (visual images) to quickly and accurately convey concepts and description information. This research will explore how the FAA can effectively employ graphic presentation of human factor information to improve the use of our documentation.

Output:
Report to include: 1) Identify a sample of approximately 100 human factors issues that are described in text in FAA documents.

2) Develop drawings, graphics, tables, pictures, or other media that can visually depict each issue.

3) Develop text that support, clarify, and explain each visual depiction.

4) Test the performance (accuracy, speed, and effectiveness) of a FAA document or section of a document that employs graphics and text Vs the same document that only uses text. Evaluation must be performed with intended document users.

5) Create a graphics library architecture that would support identifying and applying issue graphics/text. Implement a prototype library for the graphics issues described above.

6) Present a plan/schedule (time, not dates)/cost for expanding this process to the majority of human factors issues dealt with in the FAA. Include methods of adding new issues.

7) Define library ongoing maintenance procedures and estimates of resources need

Regulatory Link:
Update several AC's and TSO's, as well as form input to the Plain English guidelines which document recommendations for drafting new FAA material.

Flight Technologies and Procedures

Requirements

Requirement ID: 897 Special Category: NONE

Sponsor Organization: AIR Sponsor POC: Glen Gallaway

Keywords: Communications, Documentation, Performance (meas/imprv)

Title: HF Information Support Center - Internet Web-Site Delivery System Architecture & Design Requirements

Research Statement:
Define the architecture and design requirements for an internet web-site that will help uses search for, obtain and structure human factors information for various certification and flight standards objectives. Using the design requirements develop a working prototype web-site that will demo the delivery of information. User test the site for human factors design and performance. „h Identify user¡¦s (FAA personnel, vendors, flight crew) needs for human factors information (possibly use product of other research projects). „h Determine how the information must be formatted and presented to be useable by users (possibly use product of other research projects). „h Identify links/descriptions to related information. „h Identify the operational information that FAA Human Factors personnel need to exchange. Define the structure / layout a secured portion of the website that can be used to communication this information. Make this portion of the web-site interactive and maintainable by the owners of the information. „h Include a process for recording certification actions taken relative to equipment and processes. This information should be auto indexed. „h Implement a prototype database driven web-site. Make the web-site maintainable by professional human factors personal with little computer skills required. „h Human factor the website. Use human factors experts, graphic artists, and database experts as needed to ensure a useable, user-friendly, and effective prototype design. User supported design and testing is required. 1558

Background:
A great deal of human factors research, design, development, and information is created / obtained for use in the FAA. Often it only used by a small group because it¡¦s existence is not widely known. This information could potentially have much broader value if it was made available to all whom need it for human factors work. A good approach for broadly delivering human factors information is via an internet web-site. An effective web-site must be based on presenting the information needed by the users in a form they can readily use. This project will match user information needs with good information delivery practices.

Output:
„h Web based human factors information delivery architecture that matches the needs of the various users with the information available. „h A prototype web-site that demonstrates effective delivery of information. „h Web-site human interface that is human factored (and user tested). „h A prototype FAA human factors communications exchange site section (activities, bios, schedules, projects) maintainable by the information owners. „h A prototype site section that is a human factors educational resource (teaches HF) for internal and external personnel. This should be very limited (only show intent). „h Provide a plan for transitioning the prototype into an operational web-site. Describe maintenance requirements, cost of development, time needs, and personnel resources.

Regulatory Link:

Flight Technologies and Procedures

Requirements

Requirement ID: 892 Special Category: NONE

Sponsor Organization: AIR Sponsor POC: Glen Gallaway

Keywords: Annt/Mental Models/Cognition, Communications, Documentation, Performance (meas/imprv)

Title: HF Knowledge Central – Framework for Finding/ Applying HF Knowledge in Certification Process

Research Statement:
1. Determine the most effective way for FAA Flight Standards and Certification Personnel to identify human factors issues in their work. Field evaluation of real work required. 2. Determine the most effective way for FAA Flight Standards and Certification Personnel to obtain human factors information that meets their needs identified in # 1. Field evaluation of real work required. 3. Determine the most effective way for FAA Flight Standards and Certification Personnel to apply human factors information that meets their needs identified in # 1. Field evaluation of real work required. 4. Identify the most promising 3-5 methods/tools that support # 1, 2, and 3 above. 5. Develop prototype systems using the top 2 methods/tools identified in # 4. Use the sample cases provided for a TC approval issue and TSO approval issue. Test in the field to determine before and after performance. 6. Propose an initial implementation of the most promising method/tool system. Note: This work must be able to deal with all types of human factors issues (examples below) although they all do not have to be dealt with in the prototype demo. · Software · Cabin Cockpit Controls/Displays Interfaces · Flight Cabin Interfaces · Ground Support Interfaces · Other Aircraft Interfaces · Crew issues · Controller Issues · Communications · Maintenance 1364

Background:
The process of identifying the human factors issues in the certification process is difficult because of the complexity of the interaction between humans, equipment, procedures, and the environment. The more knowledge and experience that the participants in certification process have the more effective the process is. Unfortunately human factors knowledgeable people are not available for all certification project. In this case the people participating would benefit greatly for a support tool that helps quantify the project in terms of the human factors issues and provides the data and knowledge that can effectively equate and certify equipment and procedures. This project is to explore employing current off the shelf (COTS) solutions that will simplify and improve the human factors aspects of the certification process.

Output:
1. Report on the 3-5 most promising support methods/tools. 2. Prototype of two most promising approaches to improve obtaining and delivery of human factors information. These tested against current certification process. 3. Plan for initial implementation of the most promising method/tool system.

Regulatory Link:

Flight Technologies and Procedures

Requirements

Requirement ID: 893 Special Category: NONE

Sponsor Organization: AIR Sponsor POC: Glen Gallaway

Keywords: Automation, Communications, Data Link, Interface Design, Maintainers, Performance (meas/imprv)

Title: Integrated Modular Avionics (IMA)

Research Statement:
Human factors research is needed to facilitate the identification and resolution of human factors issues with new integrated modular avionics systems, such as the Honeywell Primus Epic IMA system.196

Background:
Integrated modular avionics (IMA) is a generic term used to describe a distributed real-time computer network aboard an aircraft, such as the Honeywell Primus Epic system. IMA systems are comprised of an avionics rack and modules which contain software functions, such as GPS, autopilot, etc. The IMA systems also propose to use several combinations of new input devices and active systems which have never been approved in isolation, much less integrated. For example, one proposed implementation is to use an interactive electronic checklist with a series of new cursor control devices (joystick, trackball, mouse, etc.). To date we have not approved an interactive checklist (for example, where the system indicates "engine on?" the pilot clicks yes- and the system goes off and starts the engine), much less with a new cursor control system. Additional feedback/labeling issues arise from the new role of the pilot of ensuring the right software/version is installed in the right rack. For example, never before has the pilot been responsible for ensuring the "autopilot module" was installed on the right card in the right slot. Given the number of issues with poor automation feedback/annunciation ("What is the system doing now, what is it going to do next", etc.) with other less automated systems, this is expected to be a major issue which requires some up front research to drive the design and certification guidance material. Thus, these new IMA systems pose many significant challenges from a human factors perspective in addition to those we traditionally think of such as crew skill and workload issues. It is anticipated this research would need to be conducted at a facility that had the ability to mock-up or prototype various implementations of IMA systems and system interfaces so that they might be evaluated. The goal is to have research to identify issues with various versions and implementations of IMA systems, including the associated input devices and integrated systems.

Output:
The results of this research is intended to mitigate risks associated with the implementation and integration of IMA systems in the aircraft as well as form the foundation for material in the human factors advisory circular (and associated RTCA document) on IMA. A report containing an industry review (what is being done/proposed by the industry such as the various versions of the Honeywell system), 2) documenting potential human factors issues with IMA systems, controls, and associated aircraft functions (flight control, communications, maintenance, etc. 3) documenting issues and recommendations for feedback requirements (what should be labeled, annunciated etc.) to ensure the pilot is in the loop where appropriate, 4) documenting issues and guidance for evaluating cursor control devices. The report should also include guidelines for evaluating individual IMA systems, control systems, as well as issues across IMA modules and with associated aircraft systems (including flight controls, communications, maintenance).

Regulatory Link:
Integrated Modular Avionics Advisory Circular and Technical Standard Order C-153. Input will feed into the AC as well as to the RTCA Special Committee- 200 document on IMA requirements.

Flight Technologies and Procedures

Requirements

Requirement ID: 806 Special Category: NONE

Sponsor Organization: AIR Sponsor POC: Glen Gallaway

Keywords:

Title: Multi-function controls

Research Statement:
Research is needed to facilitate aircraft certification specialists in the identifaction and resolution of human factors/pilot interface issues with new cursor control/display devices in flight decks, inlcuding touch screens, track balls, joy sticks and other implementations being proposed by manufacturers such as Honeywells Primus Epic system. This guidance should include certification minimum requirements and design guidance, based on research and usability assessments of new and emerging multi-function control/display systems.538

Background:
Aircraft certification specialists are currently being asked to review and approve new integrated modular avionics devices, such as the Honeywell Primus Epic system, which contain complex integrated cursor control/display devices with functionality well beyond what has been approved in the past. Serious potential consequences may arise if these specialists approve something that should not be approved, as some of these systems have cursor control devices controling aircraft systems (engines etc.). To date the FAA has no published guidance on human factors issues with these types of systems in order to determine what is acceptable and what is not. This material needs to be data driven and research is need to identify potential issues and resolutions.

Output:
Research report documenting issues and literature review. Recommended certification guidelines

Regulatory Link:
Draft new advisory circular on cursor control devices and/or update to Integrated Modular Avionics (IMA) AC.

Flight Technologies and Procedures

Requirements

Requirement ID: 611

Special Category: NONE

Sponsor Organization: AIR

Sponsor POC: Colleen Donovan

Keywords:

Title: Multi-Function Display/ Controls

Research Statement:
Human factors minimum requirements and design guidance is needed to update FAA Technical Standard Order (TSO) C113 on multi-function displays. This guidance includes certification standards to be used by aircraft certification specialists reviewing new multi-function avionics with novel features for which no FAA certification guidelines exist including: displays which concurrently multiple information such as display weather, traffic, navigation information etc. Guidance is also needed to support flight standards in determining what types of operational approvals should or should not be grated based on usability of the system, workload issues, etc. Items to be considered: guidelines foreach feature and function of typical MFD's currently on the market and likely to be on the market in the near future (as identified by manufacturers or at public functions such as Oshkosh where they demonstrate prototype systems). Sample research questions: identify issues and potential consequences of various possible combinations such as when you have red traffic on top of red terrain, on top of red weather? What should the FAA approve or certify for use? What happens when you have TCAS and ADS-B alerts being indicated simulatenously- what should our certification requirements be? Additional tasks requested by AFS for potential consideration in FYO3 and beyond: Examine issues and make recommendations for clutter/declutter, color usage, use of display for primary flight information, reversion, emergency annunciations, and display switching. Provide recommendations for prioritization of displayed data relative to operational mode, or phase of flight.1677

Background:
This research will contribute to the revision of FAA Technical Standard Order (TSO) C113 on multi-function displays, which is out of date and in need of revisions based on current technology and information requirements. This is a critical project, which is part of the AIR buisness plan, but it is not currently being adequately supported since SAE G10 is voluntary and the group membership is not adequate. Future research is expected to follow in order to follow-up and provide additional guidance in areas where not enough is known orbased on certification needs (ex. requested for combined system with both TCAS and ADS-B traffic alerts, etc.). Additional Out-year work: Multi-function controls work (controls used for multiple things). Needed- lit review and research on cursor control devices (touch pad, touch screen, track balls, mouse, etc.) and multi-function controls. Need compliation of best practices and minimum certification standards- inlcuding a list of issues for certificaiton to consider when reviewing these various input devices. Priority Criteria: Internal= 4 (AIR Buisness Plan Item III.A.2 "Submit policy memo on Human factors guidance for RTCA Avionics MOPS and FAA TSO's for AIR coordination." Policy Lead= Colleen Donovan); Potential to Reduce Accidents= 2 (Useful= "The program provides indirect support to accident reduction iniatives and expands the knowledge base in support of accident/incident prevention or mitigation initiatives." Note: it would indirectly support this by having good HF guidance up

front- in the product design); External= 3 (Important- The program supports resolution of safety issues required to develop policy as identified in REDAC, ARAC, RTCA, etc, Committees. Note: This policy would be the HF policy for all new avionics TSO's and RTCA documents); New Technology= 3 (Support for new technology= Important- "allows FAA/AVR to respond in a timely fashion with solutions or procedures for expected new technology")

Output:
This should not be considered for funding in FY-03 or afterwards. Multi-function controls item split out as a new requirement.

Regulatory Link:
TSO C-113

Flight Technologies and Procedures

Requirements

Requirement ID: 641

Special Category: NONE

Sponsor Organization: AIR

Sponsor POC: Kathy Abbott

Keywords:

Title: Error Management

Research Statement:
Human factors research is required to provide guidance and regulatory material regarding the need for better support of error management to mitigate the consequences of erroneous actions and assessments.203

Background:
This work is a continuation of work funded in FY 00 investigating the need for better support of error management to mitigate the consequences of erroneous actions and assessments (being done by Dr. Nadine B. Sarter). There are two major approaches to the problem: error prevention and error management. The prevention of errors through improved training and design has been the focus of much research and development in the past. It is widely acknowledged, however, that it is impossible to eliminate, or prevent, completely the occurrence of errors. Therefore, it will be critical to find ways to mitigate the consequences of errors that will continue to occur. To date, however, little is known about effective support for error management, which involves the following three steps: error detection, error explanation, and error correction or recovery. This research project will focus on error detection and error recovery. One of its goals is to identify, and examine the impact of, factors that contribute to successful and poor error detection performance. We will also analyze different strategies for error correction and recovery (e.g., backward, forward, or compensatory strategies) and determine their effectiveness in different task contexts. Based on this knowledge, the longer-term objective of this effort is to develop concepts for off-line support (in the form of training) and on-line support (through design) of error management, especially in the context of modern aviation technologies and operations. The methodological approach will involve both observations of pilot and crew behavior - a technique that has been used before - and more controlled studies of error management of which very few have been conducted in □this field of research. Some of the questions that will be investigated are What is the relationship between different error types/errors at different What are the□performance levels and error detection cues and processes? □reference mechanisms against which actions or their consequences are checked? How can we support□What are the main factors that lead to detection failure? operators in detecting errors of omission and errors at the knowledge-based How does self-detection□level, which tend to be more difficult to notice? differ from detection by other operators, and how can these differences be How do error detection and□exploited through training and procedures? correction performance and strategies change as operators gain more experience □ What determines the choice of an error recovery strategy? □in their domain? How well do current automation technologies support the detection of, and recovery from, erroneous actions and assessments? Research Plan. During the Review□first year of this project, the following activities will be performed: of existing knowledge and important research questions in the field of error management The findings from studies, the general applicability of their results, and the questions that remain unanswered or that were raised by this research, will be discussed and summarized in a technical report. This report will be shared with the FAA and will, to some extent, inform our subsequent Observations of pilot training at a major carrier. In□research activities. parallel with the above activity, we plan to establish a collaboration with a major airline. Our first step in this collaborative effort will be observations of training sessions and the participation in debriefing sessions to examine a) what errors are likely to be detected/missed by the crew, b) which crewmember tends to

detect the error, c) what cues/mechanisms help the person detect the problem, d) how the two crewmembers communicate about observed errors, e) what strategies they use when trying to recover from the error, and f) how successful their different strategies are. We will sample different types of modern technology aircraft to examine how differences in feedback design and automation behavior may affect error management. In particular, we hope to be able to examine error management in the context of modern technologies and operations such as FANS and RNAV operations. We will also sample pilots at different levels of experience to investigate the impact of experience and crew position on error management behavior and performance. The findings from these training observations will be summarized in a second technical report to the FAA. Together with the findings from our research review, the results of these observations will guide our next steps in this research during the second and Pilot reviews of,□third year of the project. One likely next activity will be and pilot participation in, staged simulator sessions involving various types of errors In order to go beyond naturalistic observations and instead examine specific hypotheses about error management behavior and performance, we will design a set of scenarios that involve multiple opportunities for different types of errors. The same scenarios will also be flown by one of the confederate pilots together with a naïve study participant. These different setups will help us learn more about the differences between self-detection and error detection by another operator. The above scenarios will also be staged in different contexts (e.g., high versus low time pressure), with pilots at different levels of experience, and on different flight decks to examine possible differences in error management behavior. During the second and third year of the project, we plan to address issues such as a) the detection of erroneous assumptions and actions on the part of the automation by the flight crew, b) the impact of different feedback designs on error detection performance, and c) the assessment of the most adequate error recovery strategies for different types of errors and task contexts. Our research will be conducted in the context of flight simulations at varying levels of fidelity. The findings from these research activities will enable us to collaborate with the airline on the development of new approaches to error training, especially with respect to the detection of and recovery from omission errors and errors at the rule-and knowledge-based level. Summary. Since it is impossible to eliminate errors completely, we need to find more effective ways of mitigating their consequences through training, design, and procedures. To this end, we will examine the processes and factors involved in successful and poor error management. In particular, we will investigate error detection and recovery strategies and performance for different types of errors and task contexts, different levels of pilot experience, and different flight deck designs. By conducting controlled studies of error management, our research will go beyond most earlier research in this area, which relied, for the most part, on naturalistic observations of flight crew behavior during actual line operations. We hope to contribute to the continued safety of flight operations in the future through the development of more effective approaches to error management training and through the identification of problematic system and interface designs that can hinder error detection and recovery.

Output:
Guidelines and methods for the identification of problematic system and interface designs that can hinder error prevention, detection, and recovery.

Regulatory Link:
Supports regulatory material being developed by Human Factors Harmonization Working Group for HF in FAR/JAR 25. Also applies to regulatory material for training/qualification and crew procedure design.

Flight Technologies and Procedures

Requirements

Requirement ID: 640

Special Category: NONE

Sponsor Organization: AVR

Sponsor POC: Kathy Abbott

Keywords:

Title: Human Factors Guidelines for Instrument Procedure Design

Research Statement:
Human factors research is needed to produce a set of human factors guidelines for design of instrument procedures and associated charts that are usable and flyable by appropriately qualified pilots without being susceptible to making errors.241

Background:
The purpose of this effort is to develop human factors guidelines for design of instrument procedures (and associated charting) to insure that these procedures are usable, easily flyable, and not prone to pilot errors because of design characteristics that do not adequately account for human performance and limitations. This has two aspects: one is the general aspects of instrucment procedures. the second is looking towards the future, and including procedures based on the required naviation performance of the aircraft. In particular, research should address the minimum number of approach plates per runway end, with associated issues of charting, usability, etc. This work will support work being done by AFS400 (Don Pate/Carl Moore) and AVN (Tom Accardi) Desired FAA Outcomes: Reduced CFIT occurrence because of improved instrument procedures and charting. Human factors guidelines and criteria for instrument procedure (and associated chart) design. These guidelines and criteria will be integrated into existing criteria for instrument procedure design and policy. Expected FAA Output: Results from this research study will support improvements in instrument procedure design criteria, including incorporation of new concepts such as RNP for RNAV procedures. Project Performance Goal: Develop human factors guidelines that address known difficulties with use of instrument procedures, and also address future instrument procedure requirements. Program Drivers: (See paragraph 8 above) This activity directly supports implementation of the FAA Human Factors Team Report recommendations (as per AIR business plan), the development of the AFS Human Factors plan (AFS Business plan initiative 5.4) and the Safer Skies JSIT recommendations for CFIT. Criteria: Internal Driver= 4 (based on AVR Performance Plan Appendix A-1 P. 1 initiative #2- Implement CFIT selected interventions- detailed implementation plan; and AFS FY02 plan Initiative 2.13); External Driver= 3; Potential to reduce accidents= 3 (based on CFIT JSIT Outcome #4B & #20); New Technology= 3 Note to Kathy: insert sentences from plans. Also fix up request and products (outcomes).

Output:
Guidelines suitable as a basis for inclusion in FAA TERPS/ICAO PANS OPS Guidelines for charting Minimum number of approach plates per runway end (JSIT for CFIT & Appr & Landing) Identify HF issues in moving forward

Regulatory Link:
Criteria for inclusion in 8260.3 (TERPS) Criteria for associated charting

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Flight Technologies and Procedures

Requirements

Requirement ID: 623

Special Category: NONE

Sponsor Organization: ANM

Sponsor POC: S. Boyd & K. Abbott

Keywords: Automation, Errors

Title: Certification Job Aid

Research Statement:
Human factors research is needed to provide a capability for certification personnel to evaluate flight deck designs for susceptibility to design-induced flight crew errors and the consequences of those errors as part of the type certification process.252

Background:
Research task: Develop human factors job aid for use by certification personnel. FY 01 tasks: - add additional Part 25 guidance such as TSOs, MOPS and other industry standards - identify human factors issues related to the certification of flight deck controls - add functionality such as search, notes, issue paper template, update of FARs Ranking Criteria: Internal drivers: Essential. On the AIR Business Plan for FY01 and may be on the AIR plan as well. Potential to reduce accidents: Important. The Job Aid supports flight deck design certification. Flight decks designed and certified without undue potential for flight crew error is the first line of defense in accident prevention. External drivers: Important. Supports ARAC HF HWG activities. New technology: Important. The Job Aid will provide revelent human factors information which will support the certification of new tecknogies. Note: Directly supports Change Area II (Human Factors Integration) of Certification Process Study implementation.

Output:
Support tools for certification personnel to identify HF issues.

Regulatory Link:
Supports integration of HF references with Part 25 regulations, advisory circulars, and TSO on displays.

Appendix C
Projects Grouped by AIR-130 Human Factors Specialist

Glen Gallaway

Type of Document	Topic	Focal Point	Project #
1. Advisory Circular	Controls (draft 20 series)	Gallaway	5
2. Report ?	Certification Process Study	Gallaway	8
3. Database	Human factors certification issues	Gallaway	9
4. RTCA document	Integrated Modular Avionics	Gallaway	11
5.	Focal point for AAR-100 Flight Technologies & Procedures (Research). Coordination- provide input /recommended changes to database.	Gallaway	
6. CD ROM	Avionics Workshop Presentations	Gallaway	19
Several ACs, Memos, etc.	Get Up To Speed On Core Documents	Kaliardos & Gallaway	20

Bill Kaliardos

Type of Document	Topic	Focal Point	Project #
1. Advisory Circular	Electronic Flight Bag	Kaliardos	3
2. Advisory Circular	ADS-B Cockpit Display of Traffic Information (20 series)	Kaliardos	4
3. Database	TSO Human Factors/Pilot Interface guidance	Kaliardos	10
4. AC 90-RNP & HF considerations Roadmap	RNP	Kaliardos	14
5. Policy Memo	MSL-GSL	Kaliardos	15
6. Response to NTSB, Issue Paper	ELT	Kaliardos	18
Several ACs, Memos, etc	Get Up To Speed On Core Documents	Kaliardos & Gallaway	20

Colleen Donovan

	Type of Document	Topic	Focal Point	Project #
1.	Regulation & AC	Alerting (25.1322)	Donovan	1
2.	Regulation & AC	Human Factors (25.1301- sub-paragraph e)	Donovan	2
3.	TSO & MOPS	Moving Map With Ownship	Donovan	6
4.	Order	Addressing Human Factors for Avionics as part of the TSO process (8100 series)	Donovan	7
5.	Policy Memo & MOPS	Weather Displays	Donovan	12
6.	HF Roadmap	NEXCOM	Donovan	13